United States Department of Agriculture
Forest Service
NA-FB/M-8
1984

How to

Select Planting Sites for Eastern White Pine in the Lake States

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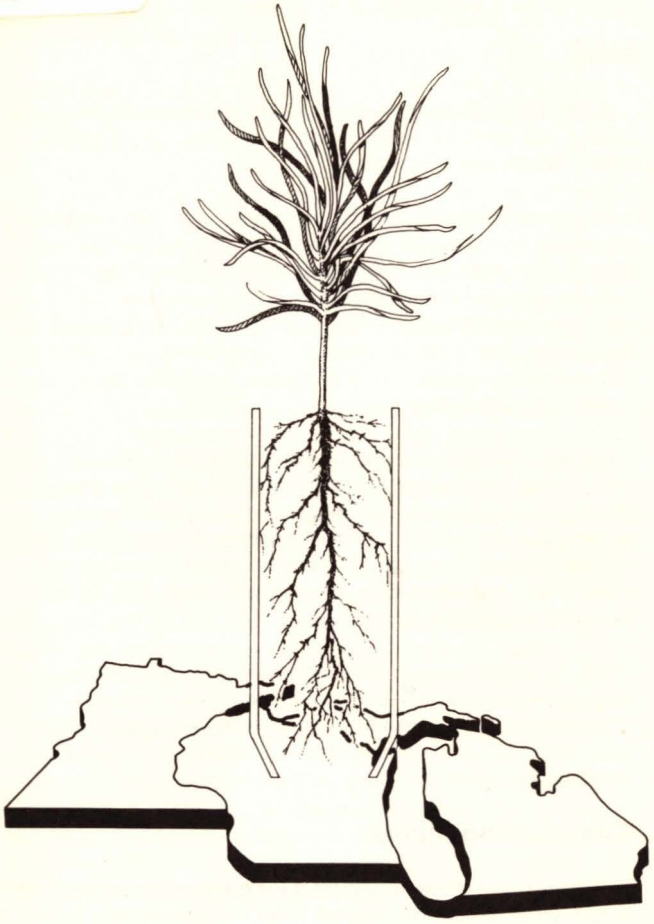

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Since the discovery of white pine blister rust (*Cronartium ribicola* Fisch.) in the Lake States during the early 1900's, concern about this disease has greatly limited the amount of eastern white pine (*Pinus strobus* L.) being planted. The threat of damage by the native white pine weevil (*Pissodes strobi* (Peck)) has reinforced this hesitancy to plant white pine.

Research over the past several decades has determined the soils, climatic conditions, topography, and stand characteristics that are associated with less damage caused by these pests and with more tree growth. By using the following guidelines, sites can be selected where white pine can be planted with lower risk of injury and higher potential for a successful plantation.

Soils

White pine grows on almost all the soil types in the Lake States, but soils for best growth are loams, sandy loams, loamy sands and fine sands.

The most productive soils, the loams, are commonly occupied by sugar maple and other northern hardwood species. Abandoned agricultural land with such soils provide excellent planting sites, but after succession to northern hardwoods, management for white pine is difficult and costly. The cost of controlling the hardwood competition and other woody brush probably is too high to justify white pine underplanting.

The fine textured sands, where red maple, white birch, aspen, and oaks are common, very likely offer the best management opportunities for successive rotations of white pine both in open fields and as underplantings. There is less competition from tolerant hardwoods than on the loam soils, and white pine, once established, can be maintained by natural reproduction.

Avoid planting white pine on heavy wet clays, soils with groundwater less than 2.5 feet below the surface, or droughty coarse sands. Although white pine grows on such soils, they usually are less vigorous and more susceptible to injury by pests.

Climatic Conditions

Blister rust infection occurs during late summer and early fall when windblown spores from *Ribes* (currants and gooseberries) leaves germinate on pine needles. Germination and infection are favored by the presence of free moisture, usually dew, on needle surfaces and by temperatures below 68°F (20°C) for at least 48 hours.

The probability of these conditions occurring varies by location within the Lake States. Figure 1 shows four hazard zones indicating the relative risk of rust infection. General levels of control are recommended for each zone.

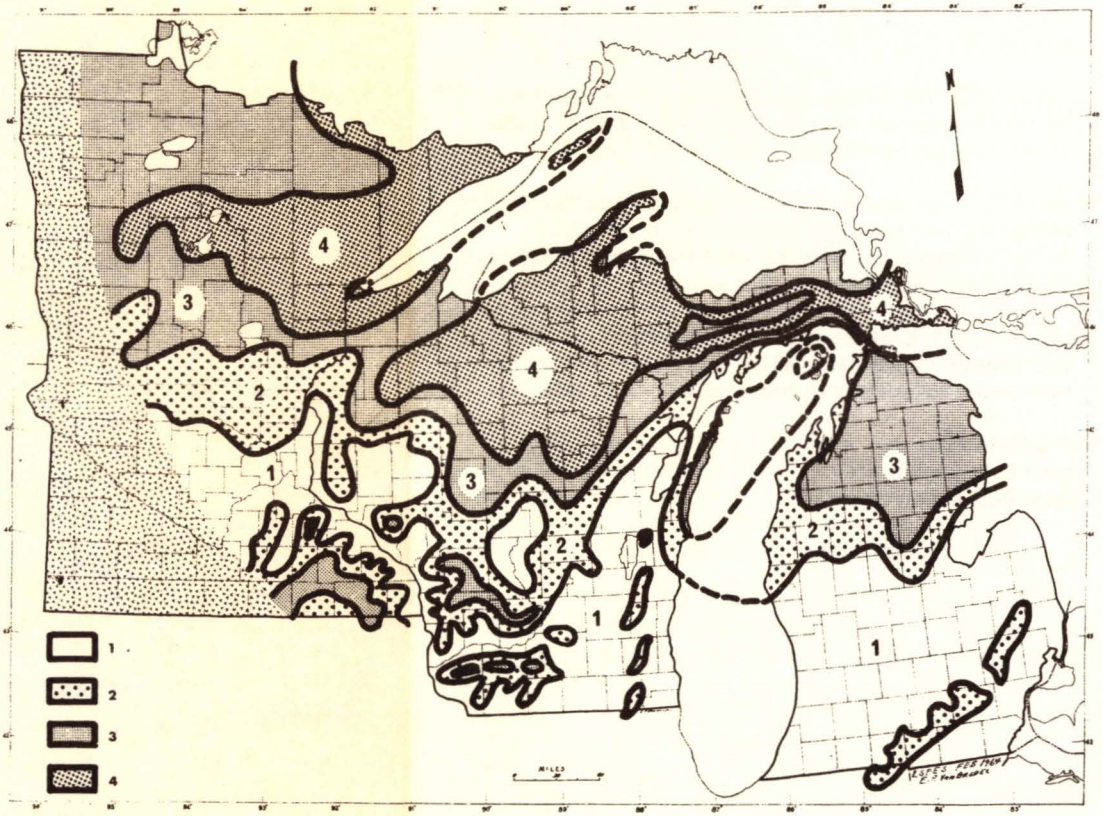
Recommended controls in Zones 3 and 4 include avoiding sites where rust hazard is high, planting blister rust resistant white pine, and pathological pruning of branches. Pathological pruning involves removing branches from the lower half of the crown beginning three years after planting and continuing periodically until the lower nine feet of the bole is free of branches.

Ribes eradication may be useful where short distance (less than 100 feet) spread of spores is important, such as much of Zone 3, around nurseries and Christmas tree plantations, but is ineffective where long distance spread is common, as in most of Zone 4. Distances that spores spread are based on an area's characteristic pattern of nighttime air currents.

Blister rust controls are not needed in Zone 1 and pathological pruning alone should prevent losses due to rust in Zone 2.

Damage by white pine weevils also varies by geographic zones. In Minnesota, for example, damage always has been greater in the northern than the southern part of the State. Unfortunately, the boundaries of these zones are not well defined and reasons for the differences in weevil hazard are unknown.

Figure 1. Map showing climatic hazard zones for potential white pine blister rust infection, ranging from Zone 1 with lowest hazard to Zone 4 with highest hazard (Source: Van Arsdel, E. P. Growing white pine to avoid blister rust-new information for 1964. Res. Note LS-42. St. Paul, MN: U.S. Department of Agriculture, Forest Service, Lake States Forest Experiment Station; 1964. 4 p.).



Topography and Stand Characteristics

In addition to using the broad hazard zones shown in Figure 1, characteristics of individual planting sites can be used to predict the likelihood of rust infection or attack by white pine weevils. These local effects are due to variations in microclimate associated with certain topographic and stand characteristics; they are especially critical in Zone 4.

In any Zone, risk of blister rust infection is greatest when white pine is planted within small forest openings with a diameter less than the height of surrounding trees, in topographic depressions, or at the bases of slopes. Microclimatic conditions in such sites favor cool temperatures and dew formation.

Rust hazard is intermediate where white pine is planted in large forest openings, in open fields, on steep slopes, or on hilltops.

The risk of injury from both rust and white pine weevil is smallest when white pine is planted under an overstory. Aspen, birch, and other light crowned species are good choices for the overstory. Conditions are warmer and drier at night under a canopy and, therefore, less conducive to rust infection. In addition, the cooler daytime temperatures and thinner bark of terminal shoots of white pine growing in the shade of an overstory discourage attacks by the weevil. A crown cover of 30 to 50 percent is recommended, followed by release when the white pines are 12 to 25 feet tall. Because white pine is intermediate in shade tolerance, there is a trade-off between reduced growth and reduced risk of pest injury when it is grown under an overstory of more than 50 percent crown cover.

Occasionally, one guideline for reducing injury by weevils, such as planting on north or east facing slopes, conflicts with one for reducing rust incidence, for example avoiding cool north facing slopes. In such situations, you must consider which pest poses the greater hazard based on geographic location and the history of injury caused by these pests in your area.

When white pine is planted in the open, close, spacing, of say, 6 by 6 feet, will increase the chances of obtaining an acceptably stocked stand by rotation age. This spacing compensates for trees lost to weevils and encourages natural pruning or rust-susceptible lower branches.

In some areas in the Lake States, the survival and growth of white pine seedlings are greatly reduced by animal damage, especially deer browsing. The history of such damage in an area should be considered when selecting planting sites.

Summary of Guidelines

Factors	Planting Recommended	Planting Not Recommended
Soils	Loams, sandy loams, loamy sands, or fine sands	Heavy wet soils, soils with a high water table, or droughty coarse sands
Climatic	In Zones 1 and 2; In Zone 3 with recommended topography and stand characteristics (see below)	In Zone 4 unless microclimate is appropriate and rust-resistant stock is used
Topography	On steep slopes or hilltops	In topographic depressions or on bases of slopes
Stand Characteristics	Under an overstory; In large forest openings or on old fields (if weevils are not a threat); Close spacing; Use resistant stock, if available.	In small forest openings; Where *Ribes* is common; In open fields if weevils are a threat.

Conclusions

Soil, climate, topography, stand characteristics, geographic location, and economic feasibility of disease and insect controls all should be considered when selecting planting sites for both blister rust resistant and regular white pine seedlings. Resistant seedlings are less susceptible to this disease, but they are not immune.

By using these guidelines, modified according to past successes and failures in your area, you can plant white pine where you will get the best return on your investment. Proper management following planting and throughout the rotation also is necessary for success. (See references.)

For additional information, contact your State forest pest specialist for State and private land or the USDA Forest Service Forest Pest Management Staff in St. Paul for Federal land.

References

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Kathryn Robbins
Forest Pathologist
Forest Pest Management